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DISPLAY DEVICE

Field of the Invention

This invention relates to a display device of particular, though not exclusive, application to illuminated display systems such as illuminated display boards.

Reference to related patent

This invention is an improvement in the invention disclosed and defined in Australian patent 647834 (AU-B-86226/91), the contents of which are hereby incorporated by reference. Throughout this specification Australian patent 647834 is referred to as the "earlier patent".

Background to the Invention

In the earlier patent there is disclosed an illuminated display system including a transparent medium having two opposing surfaces to be illuminated. The illumination is from the lower-most edge of the transparent medium. Both surfaces to be illuminated have a matrix of dots substantially covering the surfaces, resulting in an increased illumination of the surfaces.

The results using the invention of the earlier patent are an improvement over the known art, but further improvement is believed to be possible. Furthermore, the display system of the earlier patent involves the task, and associated cost, of printing a matrix of dots on both surfaces of the transparent medium.

In the earlier patent "dots" are defined as being of any size or shape, and are said to be transparent or opaque and more preferably light-coloured, for example white.

"Matrix" is defined in the earlier patent as any display or array of dots. "Transparent medium" is defined as being one or more transparent sheets which

may be glass or plastic, but are preferably acrylic.

These definitions are also adopted for this specification, including the claims.

It is the principal object of the present invention to provide a display device for use in an illuminated display system having improved performance over that disclosed in the earlier patent.

Summary of the Invention

With the above and other objects in mind, the present invention provides a display device for use in an illuminated display system. The device has a transparent medium with first and second opposing surfaces to be illuminated in use. At least one of the first and second opposing surfaces has a matrix of spots each having a hollow transparent interior substantially covering at least a major portion of the surface to be illuminated for providing an even and increased illumination throughout that portion of the respective surface. The matrix of spots does not form a or part of a message or information to be illuminated.

Preferably, the matrix covers substantially the entire surface to be illuminated.

"Spots" used in this specification, including the claims, can be of any size or shape, for example round, rectangular, ellipsoid, polygonal, triangular or irregular. A convenient and advantageous shape is an annulus.

Preferably, the hollow interior of each spot is of a shape corresponding to the outer periphery of the spot. Alternatively, the hollow interior may be of a shape different to the outer periphery of the spot.

The spots are advantageously translucent, though they may be opaque, and are preferably light coloured, e.g. white. Advantageously, only one of the first and second surfaces has the matrix of spots thereon. Alternatively, both the first

and second surfaces may have the matrix of spots thereon.

Preferably, the spots increase in size, preferably both of the external periphery and of the hollow interior periphery, with increasing distance from an edge of the medium at which a light source is located in use of the display system.

In the display system described and illustrated in the earlier patent, the dots are solid. It has been realised that by having spots with hollow transparent interiors instead of dots, light can pass not only around the outer edge of each spot, but through the hollow interior of each spot, and the adjacent edge of each hollow interior. In passing each edge, there is a refraction, or bending, of the light. It is thought that this refraction or bending of light contributes to the functionality of the display system of the earlier patent, and the present inventors have appreciated that by substituting spots having hollow transparent interiors for the dots of the prior system, the linear edge available for refraction of the light is significantly increased, and the performance of the system enhanced in terms of increased and/or more even illumination.

Brief Description of the Drawings

The invention will be further described by way of example only with reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view, not to scale, of an illuminated display system incorporating a device according to an embodiment of the invention; and

Figure 2 is an elevational view of the front surface of the transparent panel of the device, on the line 2-2 in Figure 1.

Description of Preferred Embodiment

The illuminated display system 10 illustrated in Figure 1 includes an elongate base housing 12 which serves both as a protective cover for an elongate lamp 14 and as a support base for an upstanding display device in the form of a

display board 20.

The principal component of display board 20 is a transparent panel 22 of a suitable plastics material having first and second opposing surfaces 24, 25 to be illuminated in use. The first or front surface 24 has a matrix 30 of white translucent spots 32 with hollow transparent interiors 33. In this case, spots 32 are annular spots. As depicted in Figure 2, the spots are arranged in a regular rectangular array in which the annular spots are of progressively increasing size in a direction away from the lower edge face 21 of panel 22, i.e. the edge face illuminated by lamp 14. The spacing of the spots is uniform laterally but also slowly increasing in the direction away from the lower edge of panel 22.

The front surface 24 having spots 30 thereon is overlaid by a clear or transparent white face panel 26, while rear surface 24 has a clear, transparent white or reflecting white face or backing panel 28. If desired eg. for a two-sided sign board, surface 25 may also have a matrix of spots similar to the matrix depicted in Figure 2. The display board assembly 20 is retained between a pair of spaced upstanding parallel flanges 16, 17 that define an opening 15 of housing 12. Panel 22 depends through opening 15 so that its lower edge face 21 is immediately adjacent lamp 14 for illumination of surfaces 24, 25 via the body of the panel.

Lamp 14 is typically a fluorescent tube, but may be any other suitable preferably elongate, form of light source. If a fluorescent tube, housing 12 also retains the associated ballast 18.

A second lamp may of course be provided along the top edge of panel 22, especially where the display board is of large dimensions. In alternative arrangements, lamps may extend along one or both upright edges of the panel.

It has been found that by using the spots of the present invention there is an improvement in illumination. Table 1 compares measured luminance values (B) of a 1200mm high form of board according to Figure 1 with top and bottom lamps, with those (A) for a board having a similar matrix of dots, i.e. solid spots, of similar

external shape and dimensions at similar centre-to-centre spacings. The two sets of lux readings were taken at successive positions on the front surface of the panel over its 1200mm height.

Table 1

Position of Measurement	Device A	Device B
1	148	153
2	154	165
3	103	147
4	85	134
5	93	128
6	129	139
7	134	130

As required for the device of the earlier patent, the matrix of dots was printed on both surfaces of device B. As preferred for the present invention, the matrix of spots was printed on a single surface of device A. It can be seen from Table 1 that improved illumination resulted for all positions except that closest to the lower lamp. Furthermore, the readings demonstrate an improved evenness of illumination in the central region of the panel: the maximum variation of the lowest from the highest reading is 22%, compared with 44% for the prior device. It will further be noted that the improved illumination occurred for most positions despite the printing of the spots of the present invention being on one surface only.

Whilst there has been described in the foregoing description a preferred embodiment of the present invention, it will be understood that many variations or modifications in details of design or construction may be made without departing from the essential features of the present invention.